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COLLEGE OF AGRICULTURE
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DEPARTMENT OF BIOLOGICAL CONTROL
LABORATORY OF INSECT PATHOLOGY
BERKELEY 4, CALIFORNIA

May 21, 1958

Dr. J. Lederberg
Genetics Department
University of Wisconsin
Madison 6, Wisconsin

Dear Dr. Lederberg:

During the course of our work on the use of bacteria to control insect pests, a matter has arisen on which we should greatly appreciate having the benefit of your opinion and advice. I realize that an inquiry such as this imposes on your time, but the situation with us is critical so I hope you will forgive our presumption.

We have found certain crystalliferous sporeformers (e.g., Bacillus thuringiensis, Bacillus sotto, and others) to be highly virulent for certain lepidopterous insects (e.g., alfalfa caterpillar, cabbage-worm, etc.), but completely harmless for all other kinds of life. The active lethal principle in these bacteria is a highly toxic proteinaceous crystal that is plainly visible in the sporangium of the bacterium and which is formed at the time of spore formation. These bacterium have been found only in diseased insects. We have successfully used spore (plus crystal) preparations to control destructive insects in the field, and three commercial companies are currently mass-producing spores as "living insecticides" for marketing later on in the year.

Lately, certain state and federal agencies have raised the question as to possible inherent dangers that may be associated with the use of these bacteria in the event that they should mutate or otherwise alter their pathogenic properties so as to be capable of infecting man, other animals, or plants. Some competing chemical insecticide companies have hopefully latched on to this idea, suggesting that this might occur not only with entomogenous bacteria, but with fungi, viruses, and protozoa we are similarly using in the biological control of insects. What do you think is the likelihood of this happening with an organism such as Bacillus thuringiensis?

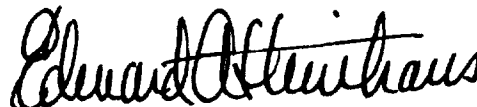
Our first reaction to this idea was that such fears are ridiculous. We pointed to the numerous other ways in which microorganisms are exploited and used for the benefit of man without such dangers arising. In fact, we have felt that there is as much likelihood of B. thuringiensis mutating into B. anthrax, for example, as there is of Streptococcus lactis, as used in dairy products, changing into S. hemolyticus, etc. However, not being geneticists, perhaps we are wrong. This is why we should like to appeal to you for an authoritative opinion, and to learn

what genetic principles might be involved.

I believe that some of the concern, as far as B. thuringiensis is concerned, arises from the fact that, if it were not for the presence of the toxic crystal, one could not distinguish it from the common soil organism Bacillus cereus. But B. cereus is also related to B. anthracis. According to Smith's presentation in Bergey's Manual, the principle difference between B. anthracis and B. cereus is that the former is pathogenic for certain vertebrates while the latter is not. Leaving aside evolutionary considerations, however, I know of no evidence that a strain of B. cereus has ever changed into a strain of B. anthracis (or vice versa). The relationship here is a phylogenetic and taxonomic one with what appears to be a well established stability of species. (So far, no one has been able to develop crystal-free strain of B. thuringiensis, although there is a very dubious report that a strain of B. cereus was made crystalliferous by passing it through insects.)

I sincerely hope that this very brief explanation is clear enough for you to be able to understand our problem. Any opinion you may care to give us relating to the mutability of bacteria, especially as it pertains to the changing of non-pathogenic forms into pathogenic forms will be most gratefully appreciated. To give you possibly a little more background with regard to B. thuringiensis, I am enclosing herewith two or three reprints which you may retain or discard.

Yours sincerely,



Edward A. Steinhaus
Professor of Insect Pathology

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